AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY 106:373–383 (1998)

Comparison of Factors Affecting Daily Variation of Blood Pressure in Filipino-American and Caucasian Nurses in Hawaii

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KEY WORDS ambulatory blood pressure; stress; daily setting; emotions; Filipino-Americans; nurses

ABSTRACT Although several studies have examined differences in daily blood pressure variability between African-American and Caucasian groups in the United States, little is known about the blood pressure variation of other ethnic groups. This study examined the effects of emotional state, setting, posture, and ethnicity on the ambulatory blood pressure of female health care workers (nurses and nurse's aides) from 2 ethnic groups: Filipino-Americans (N = 38) and Caucasians (N = 22). Ambulatory blood pressure measurements were obtained at 15-min intervals during a typical work day. Participants reported in a diary their setting (work or home), posture, mood, and specific activity at each measurement. The effects of these factors and ethnicity were examined using analysis of variance (ANOVA). The results show that for all subjects blood pressure was higher at work ($P < 0.05$), while standing ($P < 0.05$), during reports of negative moods (anxiety, anger, or sadness) ($P < 0.05$), and while engaging in activities such as interacting with fellow staff members at work and "washing up" at home. However, the Filipino-American women reported negative moods more frequently than their Caucasian counterparts ($P < 0.05$), had a greater proportion of readings taken while standing at work, and reacted differently than the Caucasian women to some specific activities; for instance, their blood pressure was not elevated when doing household chores. These results suggest that the extent of blood pressure variation in daily life may depend upon cognitive processes which are influenced by the cultural background and emotional state of the individual. They further suggest that ethnicity has an important impact on blood pressure variation. Am J Phys Anthropol 106:373–383, 1998.

Human biological diversity includes characteristics that span a gradient between those predominantly due to genetic influences and those that stem from environmental effects. Moreover, some of the biological traits exhibit plasticity, with individuals showing changes in the characteristics over time. Those characteristics with extreme plasticity may be more clearly labeled "states" than "traits." Blood pressure (BP) is a characteristic that, due to its continuous fluctuation over time, fits the definition of a state (James, 1991b).

Many studies have suggested that the neuroendocrine arousal arising from psychosocial stress may be an important factor in

Contract grant sponsor: American Heart Association, Hawaii Affiliate.

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Received 2 September 1997; accepted 8 April 1988.

the causation of essential hypertension and subsequent cardiovascular morbidity (e.g., Henry, 1988; James et al., 1989). Laboratory-based investigations have identified many stress-inducing factors that increase neuroendocrine activity and subsequent BP levels under controlled conditions (e.g., James and Brown, 1997). These studies, however, are not easily generalizable to real life situations (e.g., Harshfield et al., 1989; Van Egeren and Sparrow, 1989; Pickering and Gerin, 1990), suggesting that the study of BP changes in real life situations may be more useful in understanding the stress-related precursors of hypertension (James, 1991a).

The development of non-invasive ambulatory blood pressure (ABP) monitors over the past 15 years has allowed the study of BP responses to normal daily life (Pickering et al., 1982; O'Brien et al., 1995; James and Brown, 1997). Information from diaries during ABP monitoring has shown that daily BP variability is associated with changing moods and activities (James et al., 1986; James and Pickering, 1991; Gellman et al., 1990; Southard et al., 1988; Schwartz et al., 1994; Ewart and Kolodner, 1994). BP has also been found to vary with posture (standing, sitting, or reclining) (Schwartz et al., 1994) and changes in daily location, such as going from work to home (Schwartz et al., 1994; James and Brown, 1997).

Studies of urban women employed outside the home have shown that the differential effects of stress in the work or home environments significantly impact on daily BP variation (James et al., 1996). The extent of this variation may be modified by psychological characteristics such as high effort coping (Light et al., 1995), coping style (Broege et al., 1997), the perception that work is a stressful place (James et al., 1991), and other factors such as the number of children at home (James et al., 1989). Ethnicity may also have an impact on how BP varies during the day; however, studies to date have only compared gross patterns of variation between African-American and Caucasian women (Harshfield et al., 1990; James, 1991a; Prisant et al., 1991). Primarily, these studies have focused on the difference between awake and sleep pressures, and their results have been inconsistent (James, 1991b). Few if any studies have compared the factors that affect the daytime variability of BP between women of other ethnic backgrounds. A detailed analysis is required in which ethnic differences in both the amount of time experiencing given environmental circumstances and the emotional interpretation of these circumstances must be considered to gain understanding of their impact on daily BP variability.

Filipino-American women have high prevalence rates of hypertension and high mortality rates from cerebrovascular accidents relative to other women in the state of Hawaii (Bennett et al., 1962; Burch, 1978). Filipino women, specifically those of Ilocano background who make up the majority of immigrant Filipinos in Hawaii (Alcantara, 1973), traditionally have been responsible for household chores and child care, even when they are working in an urban setting (Nydegger and Nydegger, 1966; Mendez and Jocano, 1974). Thus, Filipino women may be confronted with great stress from juggling work and home responsibilities. Of particular interest is whether Filipino-Americans differ from other women in their ABP responses to mood, activity, posture, and daily setting, and whether the women perceive similar situations differently in terms of mood reports. Therefore, the purpose of this study was to examine and compare the ABP responses of Filipino-Americans and Caucasian women in relation to reported moods, activities, and posture both at work and at home. In order to standardize the daily situation, the women studied were all employed in the same occupations (nurses and nurse's aides).

MATERIALS AND METHODS

Subjects and setting

A total of 60 women participated in the study (1 other subject removed the ABP cuff after 4 hr due to bruising of her arm and was therefore excluded). They were all nurses or nurse's aides employed at 1 of 2 health care facilities: Hilo Medical Center and Life Care Center of Hilo, located in the city of Hilo, Hawaii. All female, full-time nurses working on the day shift were potentially eligible for the study. Subjects were excluded if they

TABLE 1. Selected biological characteristics of the sample, by ethnicity (means ± standard deviations)[1]

	Filipino-Americans	Caucasians	*P*
Age (years)	33.8 ± 6.0	38.1 ± 6.8	<0.05
Stature (cm)	152.9 ± 5.8	164.6 ± 5.9	<0.001
Weight (kg)	57.1 ± 8.8	71.8 ± 14.9	<0.001
Circumferences (cm)			
Waist	75.3 ± 7.3	81.9 ± 12.4	<0.05
Hip	94.5 ± 7.6	106.6 ± 10.7	<0.001
Skinfolds (mm)			
Triceps	23.4 ± 5.6	24.6 ± 7.9	N.S.
Subscapular	27.1 ± 8.0	22.9 ± 10.9	N.S.
Body mass index (kg/m^2)	24.4 ± 3.2	26.5 ± 5.3	N.S.
24-hr averaged SBP (mm Hg)	118.7 ± 10.3	118.7 ± 8.5	N.S.
24-hr averaged DBP (mm Hg)	75.5 ± 7.5	74.3 ± 6.9	N.S.

[1] SBP = systolic blood pressure; DBP = diastolic blood pressure; N.S. = not significant.

TABLE 2. Categories of activities engaged in by subjects, based on diary entries

At work	At home
Interacting with patients	Relaxing
Interacting with staff	Doing household chores
Giving or receiving reports	Child care
On break	Eating a meal
Passing out medications[1]	Washing up; changing clothes
Feeding a patient[2]	
Bathing a patient[2]	

[1] Professional nurses only.
[2] Nurse's aides only.

were diagnosed with cardiovascular or other major health problems, were post-menopausal, weighed more than 200 lb, were not of Filipino-American or Caucasian ethnicity, were pregnant, or on a drug therapy regimen. Only 5 eligible subjects declined the invitation to participate in the study. Subjects included 38 Filipino-Americans, 16 of whom were professional nurses and 22 were nurse's aides, and 22 Caucasians of whom 18 were professional nurses and 4 were nurse's aides. Selected biological characteristics of the participants are shown in Table 1. As indicated, the Caucasian women were taller, heavier, and slightly older than the Filipino-American women.

Procedure

All participants filled out questionnaires and underwent an anthropometric battery on the day before beginning the ABP monitoring. At this time the ambulatory monitors were tested on the subjects. The monitor used was the Spacelabs 90207 (Spacelabs, Redmond, WA), which is an oscillometric device that has been previously validated (Cates et al., 1990). In the testing procedure, 3 calibration readings in the seated position were taken simultaneously by means of a "T" connector between the monitor and a mercury column. Readings had to agree within 5 mm Hg for both systolic and diastolic pressure on all 3 attempts for the machine to be used the following day. Subjects were then instructed on procedures to be followed during the monitoring period.

Subjects were fitted with the monitors just prior to beginning work, at which time 3 additional calibration readings were taken following the testing procedure noted above. During the day of study the women filled out diaries immediately after each BP reading, which occurred at 15-min intervals. They recorded their location (work, home, or other), body position (standing, sitting, or reclining), general activity, and on a 10-point scale whether and to what degree they experienced any of the following moods: anxiety, anger, happiness, or sadness. Activities recorded in the diaries were aggregated into categories that are noted in Table 2.

Analysis

Approximately 16 BP readings from each of the waking locations (work and home) were used in the analysis (work, N = 16.0; home N ranged between 3 and 16 with a mean of 14.2). These readings were those taken over the first 4 hr in each location. The lower number of readings in the home setting was due to the fact that not all subjects spent their entire evening in activities at home.

In order to examine the variability of BP associated with location, posture, and mood in the 2 ethnic groups, each subject's individual BP readings during the monitoring period were converted into z-scores, using the individual's 24-hr mean and standard deviation following the procedures of James et al. (1994). Adjusting the readings with z-scores put all BPs on the same relative scale, removing the between subjects' variability in absolute level of BP and essentially removing the effects of between sub-

jects' BP variation on analyses. Thus, tests of the effects of mood, posture, setting, and activities on z-scores of BP would yield average z-scores close to zero where these associations are not present, while average z-scores substantially greater or less than zero would indicate significant associations.

For most analyses, mood reports were scored on the basis of whether or not any given mood was reported at the time of a BP measurement. For the 60 participants there is a total of 1,809 readings taken at work and home. There were few reports of sadness (38 of the reporting times) or anger (73 times) by participants, but reports of anxiety (321 times) or happiness (845 times) were more common. Therefore, reports of anxiety, anger, and sadness have been summed into a single category of generally negative moods. Such a summary category of negative moods is frequently more predictive of ABP variability than any single mood (Southard et al., 1986). The actual number used to designate a mood report is analyzed separately as the "intensity" of mood. Comparisons of ethnic differences in frequency of reporting of different mood categories were performed by χ^2 analyses, with these analyses performed separately for all waking times, only work times, and only home times. Similar analyses were carried out for comparisons of frequencies of different mood categories reported at home vs. work and while standing vs. sitting.

Ethnic differences in intensity of reported moods were analyzed by means of *t*-tests for all waking times, as well as for times when at work or home, respectively. The variations in the transformed measures (z-scores) of BP associated with reported moods, location, and ethnicity were analyzed using *t*-tests and multiple analysis of variance (ANOVA). Separate analyses were also performed to assess the relationships between the above variables and specific activities.

An ANOVA was carried out to determine the main effects of ethnicity, reported mood, setting (work vs. home), and posture (sitting vs. standing) on the z-scores of BP. Separate analyses were carried out for reported negative moods and happiness, respectively. To reduce interaction effects, 2-way ANOVAs were carried out to observe the main effects of ethnicity and reported mood on the subjects in specified settings and postures. Since most time at work was spent standing, while at home subjects spent about an equal amount of time standing or sitting, the ANOVAS were carried out separately for times when subjects were standing at work, standing at home, and sitting at home.

Analyses of the relationship between activities and z-scores of BP were performed separately for the work and home settings using *t*-tests. At work, activities for all subjects were categorized into whether or not they interacted with patients, interacted with staff (fellow nurses or physicians), or were getting or receiving reports, while home activities were categorized into whether or not they were relaxing, doing household chores, engaged in child care, or washing up/changing clothes (see Table 2). Comparisons of frequency of time performing these activities by the 2 ethnic groups were made using χ^2 analyses.

RESULTS

Interrelationship of mood, setting, ethnicity, and posture

Filipino-Americans are significantly more likely than Caucasians to report feeling anxious ($\chi^2 = 10.5$, $P < 0.01$), angry ($\chi^2 = 6.3$, $P < 0.05$), and sad ($\chi^2 = 4.4$, $P < 0.05$), and are also more likely to report generally negative moods (see Table 3A), while Caucasians are significantly more likely to report happiness (see Table 3B). There are no significant ethnic differences in the reported intensity of any of the moods when it is reported as present (2-tailed *t*-tests: $t = 0.6$ for negative moods and $t = 1.0$ for happiness).

Table 3 also notes that participants reported negative moods at work significantly more frequently than at home and reported happiness at home more frequently than at work. Intensity of reported negative moods is significantly greater at work than at home when these moods are reported present ($t = 2.0$, $P < 0.05$) and the intensity of reported happiness is greater in the home setting than at work ($t = 4.4$, $P < 0.001$) during times when that mood is reported as present. Results obtained in relation to reported anxiety are similar to those (summa-

TABLE 3. Frequency of mood reports by ethnicity (FA vs. C), setting, and posture[1]

	Frequency of mood reports	χ^2	*P*
A. Negative Mood Reports (Anxiety, Anger, or Sadness)			
All times, FA	0.28	25.1	<0.001
All times, C	0.17		
All S, at work	0.31	69.4	<0.001
All S, at home	0.15		
All S, standing	0.31	64.8	<0.001
All S, sitting	0.18		
All S, reclining	0.06		
At work, FA	0.35	10.1	<0.002
At work, C	0.26		
At home, FA	0.19	19.3	<0.001
At home, C	0.08		
B. Reported Happiness			
All times, FA	0.41	34.3	<0.001
All times, C	0.55		
All S, at work	0.44	8.0	<0.01
All S, at home	0.50		
All S, standing	0.43	19.4	<0.001
All S, sitting	0.55		
All S, reclining	0.46		
At work, FA	0.37	23.9	<0.001
At work, C	0.53		
At home, FA	0.46	11.5	<0.001
At home, C	0.57		

[1] FA = Filipino-Americans; C = Caucasians; S = subjects.

TABLE 4. Comparison of the effect of reported mood on z-scores of BP (t-tests)[1]

Mood	z-score of SBP	z-score of DBP
Negative mood		
Reported	0.28	0.28
Unreported	−0.09	−0.09
P	<0.001	<0.001
Happiness		
Reported	−0.08	−0.04
Unreported	0.07	0.04
P	<0.001	N.S.

[1] SBP = systolic blood pressure; DBP = diastolic blood pressure; N.S. = not significant.

TABLE 5. Comparison of z-scores of BP at work vs. at home and while standing vs. sitting (t-tests)

	z-score of SBP	z-score of DBP
Setting		
At work	0.11	0.29
At home	−0.12	−0.33
P	<0.001	<0.001
Posture		
Standing	0.16	0.25
Sitting	−0.09	−0.13
P	<0.001	<0.001

rized here) obtained in relation to reported negative moods.

The women were more likely to be in a standing posture at work than at home ($\chi^2 = 260.8$, $P < 0.001$). No one admitted to lying down on the job, but participants reported reclining during 19% of measurements in the home setting. Filipino-Americans were more frequently standing during measurements than Caucasians (57.8% vs. 51.8% of time; $\chi^2 = 6.2$, $P < 0.05$). This ethnic difference in frequency of time standing was significant only in the work setting (Filipino-Americans standing 81.6% vs. Caucasians standing 71.1% of time; $\chi^2 = 14.5$, $P < 0.001$). The ethnic difference is explained in part by the greater percentage of Filipino-Americans who are nurse's aides as opposed to professional nurses, as nurse's aides spend a significantly greater percentage of time standing at work than do professional nurses (82.3% vs. 73.5% of time; $\chi^2 = 10.1$, $P < 0.01$).

A negative mood is significantly more frequently reported when standing as opposed to sitting and happiness is more frequently reported when sitting as opposed to standing (Table 3). This is true in both the work and home settings.

Relationship between ABP and mood, setting, ethnicity, and posture

Times of reported negative mood are associated with both significantly elevated systolic blood pressure (SBP) z-scores ($t = 6.9$, $P < 0.001$) and diastolic blood pressure (DBP) values ($t = 6.9$, $P < 0.001$). Times when happiness is reported are generally associated with lower BP values (SBP: $t = 3.2$, $P < 0.001$; DBP: $t = 1.8$, $P = 0.07$) (Table 4). As shown in Table 5, BP values are significantly elevated at work relative to home. BP values are significantly higher when standing than sitting, as also shown in Table 5.

For reported anxiety, Caucasians experienced greater increases in z-scores of DBP when the mood was reported than did Filipino-Americans ($t = 2.4$, $P < 0.05$), although there was no significant ethnic difference in z-scores of SBP based on reported anxiety [$t = 0.0$, not significant (N.S.)]. There were no significant ethnic differences in the magnitude of BP changes due to reported anger (SBP: $t = 0.9$, N.S.; DBP: $t = 1.1$, N.S.) or

TABLE 6. ANOVAs with reported negative mood as a main effect

	F	*P*
SBP		
Main effects		
Setting	0.0	N.S.
Reported negative mood	25.6	<0.001
Ethnicity	2.1	N.S.
Posture	17.1	<0.001
Significant interactions		
Setting × posture	21.8	<0.001
Setting × posture × negative mood	5.9	<0.05
DBP		
Main effects		
Setting	16.6	<0.001
Reported negative mood	22.5	<0.001
Ethnicity	4.8	<0.05
Posture	37.0	<0.001
Significant interactions		
Ethnicity × posture	17.6	<0.001
Ethnicity × negative mood	4.9	<0.05
Ethnicity × setting	5.1	<0.05
Setting × posture	28.1	<0.001
Negative mood × posture	12.2	<0.001
Ethnicity × setting × posture	7.1	<0.01
Posture × setting × negative mood	13.2	<0.001
Ethnicity × posture × reported anxiety	4.9	<0.05
Posture × setting × reported anxiety	17.5	<0.001

TABLE 7. ANOVAs with reported happiness as a main effect

	F	*P*
SBP		
Main effects		
Setting	1.4	N.S.
Reported happiness	9.3	<0.01
Ethnicity	0.2	N.S.
Posture	15.1	<0.001
Significant interactions		
Setting × posture	13.9	<0.001
DBP		
Main effects		
Setting	64.5	<0.001
Reported happiness	2.2	N.S.
Ethnicity	0.2	N.S.
Posture	21.7	<0.001
Significant interactions		
Ethnicity × setting	17.3	<0.001
Setting × posture	11.9	<0.001

TABLE 8. ANOVAs of the effects of ethnicity and reported mood on z-scores of BP

	SBP		DBP	
	F	*P*	F	*P*
Standing at Work				
Main effects				
Ethnicity	0.1	N.S.	4.1	<0.05
Reported negative mood	10.1	<0.01	4.9	<0.05
Significant interactions				
None				
Main effects				
Ethnicity	0.0	N.S.	3.4	<0.07
Reported happiness	9.6	<0.01	4.8	<0.05
Significant interactions				
None				
Standing at Home				
Main effects				
Ethnicity	4.7	<0.05	13.6	<0.001
Reported negative mood	10.5	<0.001	24.0	<0.001
Significant interactions				
None				
Main effects				
Ethnicity	1.6	N.S.	6.4	<0.01
Reported happiness	0.7	N.S.	1.5	N.S.
Significant interactions				
None				
Sitting at Home				
Main effects				
Ethnicity	1.0	N.S.	2.9	N.S.
Reported anxiety	0.1	N.S.	0.0	N.S.
Significant interactions				
None				
Main effects				
Ethnicity	0.0	N.S.	9.8	<0.01
Reported happiness	3.0	N.S.	0.0	N.S.
Significant interactions				
None				

happiness (SBP: $t = 0.6$, N.S.; DBP: $t = 0.8$, N.S.).

As shown in Table 6, there are significant main effects on SBP due to reported negative moods and posture, as well as significant interaction effects. For DBP, there are significant main effects from reported negative moods, posture, ethnicity, and setting, as well as significant interaction effects. Table 7 shows significant main effects on SBP from reported happiness and posture, and a significant interaction effect between setting and posture, while for DBP there were significant main effects from setting and posture, with significant interaction effects from ethnicity × posture and setting × posture.

Two-way ANOVAs, shown in Table 8, indicate that reported negative mood is significantly associated with elevated z-scores of ABP in the standing posture both at work and at home, but is not associated with elevated BP while sitting at home. There are only a total of 61 times (14.6% of times) at which negative moods are reported while sitting at home. There is a significant main effect on SBP and DBP from ethnicity while standing at home and on DBP while standing at work: this is in part because Caucasians are significantly less likely to report negative moods under these conditions than are Filipino-Americans (standing at work: $\chi^2 = 6.6$, $P < 0.01$; standing at home:

$\chi^2 = 17.0$, $P < 0.001$). Happiness is only significantly related to z-scores of ABP when subjects were standing at work.

Activities, ethnicity, and BP

There is no significant difference in z-scores of BP between times interacting with patients or not (independent sample *t*-tests) or between times getting/receiving reports or not. However, z-scores of BP are significantly elevated during times when the women interacted with fellow staff members (SBP: $t = 2.1$, $P < 0.05$; DBP: $t = 2.3$, $P < 0.05$). A 2-way ANOVA was carried out for z-scores of BP with ethnicity and whether or not interacting with staff as main effects; no significant effect from ethnicity was observed. There is no significant difference in z-scores of either SBP or DBP between times on work breaks or not.

Filipino-Americans spend a significantly greater frequency of time interacting with patients while at work than Caucasians ($\chi^2 = 13.3$, $P < 0.001$). This may be due in part to the significantly greater frequency of patient interaction by nurse's aides relative to professional nurses ($\chi^2 = 8.9$, $P < 0.01$). There is no significant ethnic difference in frequency of interaction with patients for professional nurses, but Filipino-American nurse's aides spend a significantly greater frequency of time with patients than Caucasian nurse's aides ($\chi^2 = 12.3$, $P < 0.001$). Caucasians spend a significantly greater frequency of time giving and receiving reports than Filipino-Americans ($\chi^2 = 17.1$, $P < 0.001$); this ethnic difference is statistically significant for nurse's aides ($\chi^2 = 27.7$, $P < 0.001$) but not for professional nurses ($\chi^2 = 0.0$, N.S.). Also, Caucasians report interacting more frequently with fellow staff than Filipino-Americans ($\chi^2 = 4.2$, $P < 0.05$). There is no significant ethnic difference in frequency of times reported on break from work ($\chi^2 = 0.9$, N.S.).

A common specific task for professional nurses is giving out medications to patients; this task is associated with significantly elevated z-scores of DBP in the nurses (SBP: $t = 1.6$, N.S.; DBP: $t = 2.7$, $P < 0.01$); a 2-way ANOVA detected no significant effects on DBP from ethnicity. Common specific tasks for the nurse's aides, who are primarily Filipino-Americans, are feeding and bathing patients. Z-scores of SBP are significantly lowered in the aides while feeding patients (SBP: $t = 2.2$, $P < 0.05$; DBP: $t = 0.5$, N.S.), but there is no significant difference in z-scores of BP between times when bathing patients and when not engaged in that activity (SBP: $t = 1.0$, N.S.; DBP: $t = 0.7$, N.S.) despite the relatively higher amount of physical effort involved compared with most other tasks on the job.

Filipino-American professional nurses report a greater frequency of time passing out medications than do Caucasian professional nurses ($\chi^2 = 6.5$, $P < 0.01$). There are no significant ethnic differences in frequency of time spent bathing or feeding patients by nurse's aides.

At home, measurements coinciding with times classified as "relaxing" are associated with significantly reduced z-scores of BP (SBP: $t = 8.4$, $P < 0.001$; DBP: $t = 9.4$, $P < 0.001$); ANOVAs do not show a significant main effect from ethnicity. Measurements taking place during household chores show significantly elevated BPs (SBP: $t = 3.5$, $P < 0.001$; DBP: $t = 4.6$, $P < 0.001$); ANOVAs show significant effects from ethnicity. Accordingly, comparisons of BPs when doing chores or when not were performed separately for the 2 ethnic groups. Among Caucasians, z-scores of BP are significantly elevated while performing household chores (SBP: $t = 3.4$, $P < 0.001$; DBP: $t = 6.2$, $P < 0.001$). However, for Filipino-Americans, there is no significant difference in BP between times doing household chores and when not so engaged (SBP: $t = 1.7$, N.S.; DBP: $t = 1.1$, N.S.). Women are more likely to report negative moods ($\chi^2 = 7.4$, $P < 0.01$) and less likely to report being happy ($\chi^2 = 5.7$, $P < 0.05$) while doing household chores. When ethnic groups are considered separately, Filipino-Americans are significantly more likely to report negative moods ($\chi^2 = 9.1$, $P < 0.01$) and less likely to report happiness ($\chi^2 = 19.1$, $P < 0.001$) during household chores, while these mood reports are not significantly different in frequency during chores than at other times at home for Caucasians. Activities categorized as "child care" are not associated with changes in z-scores of BP (SBP: $t = 0.5$, N.S.; DBP: $t = 0.4$, N.S.) for the women. Meal times are

associated with significantly elevated BP (SBP: $t = 3.3$, $P < 0.001$; DBP: $t = 5.9$, $P < 0.001$); ANOVAS show no significant main effects from ethnicity. Finally, measurements of SBP taken during activities characterized as "wash up/changing clothes" are significantly elevated (SBP: $t = 3.7$, $P < 0.001$; DBP: $t = 1.3$, N.S.); ANOVAs show no significant main effects from ethnicity.

Filipino-Americans report a significantly higher frequency of time spent at home doing child care then do Caucasians ($\chi^2 = 4.0$, $P < 0.05$). There are no significant ethnic differences in reported frequency of times spent doing household chores ($\chi^2 = 0.0$, N.S.), relaxing ($\chi^2 = 2.8$, N.S.), eating meals ($\chi^2 = 0.1$, N.S.), or washing up ($\chi^2 = 0.0$, N.S.).

DISCUSSION

The primary objective of this study was to understand how the interaction of reported mood, ethnicity, daily setting, and posture affected the daily variability of ABP. The results show that the interaction of these factors is complex and has significant effects on daily BP variability. In general, the findings show that standing posture, work setting, and reported anxiety are associated with elevated BP, while a sitting posture, home setting, and reported happiness are associated with lowered BP. Also, elevated BP is associated with work-related activities such as interacting with coworkers and giving out medications, and with such home-related activities as eating meals, doing household chores, and washing up. Relatively lower BP is associated with activities such as feeding patients at work and relaxing at home.

The finding that BP is higher at work than at home supports those from many other studies (e.g., James et al., 1986; Pickering et al., 1982; Clark et al., 1987; Llabre et al., 1988), with this study indicating an average rise of 1.7 mm Hg for SBP and 5.2 mm Hg for DBP. The BP elevation at work was to some extent expected in the current study, since nursing and other health care occupations are generally considered stressful (Theorell et al., 1993). The amount of increase in BP at work has varied from study to study, in part due to differences in the population sampled and in the specifics of the work environment (James, 1991b). Interestingly, in this study, Filipino-Americans had a somewhat greater increase in SBP at work relative to home compared to Caucasian coworkers, with differences of 3.0 and 0.2 mm Hg, respectively (ANOVA: main effect from ethnicity, $F = 3.3$, $P = 0.07$; covariates age, $F = 3.6$, $P = 0.06$; and body mass index, $F = 1.0$, N.S.).

The time spent in a given posture differs substantially by daily setting. The nurses spend most working hours in a standing posture but are more likely to sit or lie down when at home. Mood reports are related to posture, with negative moods such as anxiety and anger more frequent when subjects are standing than sitting, and happiness more common when sitting, both in work and in home settings. Setting and mood are clearly connected as well, with these women experiencing a greater frequency of negative emotions at work and reporting greater happiness at home. These relationships are coincidental rather than causal; it is hard to imagine that a mood could only be felt in a given posture or be caused by that posture, although a given type of job (and thus the work setting) does necessitate specific postures.

Ethnicity is related to these factors, although sometimes in an indirect way. The greater frequency of standing posture in Filipino-Americans when at work is due to their higher frequency in nurse's aides positions. Professional nurses spend more time sitting down while organizing staff activities and doing paperwork than do aides. Ethnic effects on reports of mood are somewhat more difficult to interpret. While Filipino-Americans report negative moods more frequently and happiness less frequently than Caucasians, the reported intensity of these moods is not different between the 2 ethnic groups. Of interest is the finding that Caucasians have a greater increase in DBP when they report anxiety than do Filipino-Americans. One explanation for these results is that the differences are based on cultural differences in reporting mood: the Filipino-Americans are more likely to report a negative mood, even if it is of low intensity, while

the Caucasians usually report a mood only if it is fairly intense but rate it relatively low in magnitude. Therefore, when Caucasians report a negative mood it is on average of greater intensity than those reported by Filipino-Americans and hence has a greater impact on BP.

The findings of this study support the notion that population differences in ABP are based in part upon the interaction of ethnicity with such factors as perceived mood, setting, and posture. In a study of ethnic differences in BP variability in women in New York City employed as clerical workers, there were no significant daytime differences in BP (work or home) between Caucasian and African-American women (James, 1991a). However, the African-American women had higher BP during sleep than the Caucasian women, independent of how stress was experienced during the day, their weight, age, or the menstrual phase when the measurements were taken (James, 1991a). Other studies of African-Americans have also shown an increased BP during sleep compared with Caucasians (Harshfield et al., 1989, 1990; Murphy et al., 1988). These ethnic differences probably owe more to environmental than to genetic causes, particularly given the great genetic diversity included within the ethnic labels "African-American" and "Caucasian" (James, 1991a). There are certainly differences in the home settings of many African-Americans and Caucasians based on social, cultural, and economic factors, with these differences likely to effect such biological responses as BP (James and Pickering, 1993).

The finding of an ethnic difference in reactions to household chores in the current study may be an example of a culturally based difference in the relationship between activities, mood, and ABP. While Filipino-American women report negative moods more frequently while doing household chores than do Caucasians, they do not have a significant elevation of BP during the chores as do Caucasians. The manner of reporting moods as well as the meaning to the women of different activities differ based on their ethnic affiliation.

There are additional factors that can influence variability in BP such as ingestion of alcohol or caffeine and the inhalation of nicotine (Joint National Committee, 1993; Kaplan, 1992). Subjects in this study were not requested to note whenever they used one of the above substances and therefore BP variability due to these factors cannot be assessed. There are ethnic differences in the use of these factors, however, based on answers to a questionnaire on health habits that each subject completed prior to participation in the study. None of the Filipino-Americans reported use of alcohol, while over half of the Caucasians reported some use of alcohol. Drinkers have significantly lower SBP at home, during sleep, and averaged over the 24-hr observation period, while their DBP is significantly lower during sleep; thus some of the ethnic effects on BP reported here may be moderated by different drinking habits. None of the Filipino-Americans report being cigarette smokers, while more than one third of Caucasians reported smoking. There is no significant difference in BP between smokers and non-smokers in this study, although it is probable that BP was elevated in smokers at times when they engaged in that activity (Mann et al., 1991). Caucasians were also more likely to report being coffee drinkers than Filipino-Americans. As with smoking, no significant difference in BP between coffee drinkers and non-drinkers is present in this sample of working women, but BP may well become temporarily elevated in coffee drinkers immediately after ingestion of coffee (Izzo et al., 1983). Therefore, ethnic effects on BP in this study may also be moderated by ethnic differences in smoking and coffee drinking habits.

Given the number of factors likely to influence BP, the findings of any single study must be viewed with some caution. The results reported here point to the complexity in causation of BP variability in normotensive working women, particularly when consideration is given to ethnic differences. Nevertheless, the results from this study highlight the need to consider interactions between ethnicity as well as place and posture in attempting to understand the relationship between mood and BP. People vary greatly in the emotional meaning of experi-

ence depending upon where they are, how they feel, and who they are, and this variation has an impact on the individual's physiology and health.

ACKNOWLEDGMENTS

We thank Amy Jones and Linda Dickie for their help in data collection, and the nurses, nurse's aides, and nursing supervisors who participated and/or supported our research efforts for their patience.

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